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Himeno

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(54) **FIXING DEVICE**

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(22) Filed: **Jul. 6, 2015**

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(52) **U.S. Cl.**
CPC ***G03G 15/2053*** (2013.01)

(58) **Field of Classification Search**
CPC G03G 15/2053
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,427,729 B2 * 9/2008 Asakura G03G 15/2017 100/300
2003/0086736 A1 * 5/2003 Sekiguchi G03G 15/2053 399/328
2007/0014601 A1 * 1/2007 Yasuda H05B 6/145 399/329
2007/0019063 A1 * 1/2007 Yasuda G03G 15/2042 347/223
2007/0201916 A1 * 8/2007 Ueno G03G 15/2042 399/334
2009/0142114 A1 * 6/2009 Yasuda G03G 15/2053 399/333
2009/0232565 A1 * 9/2009 Yasuda G03G 15/2057 399/328
2009/0317157 A1 * 12/2009 Murakami G03G 15/2057 399/333
2009/0317158 A1 * 12/2009 Murakami G03G 15/2057 399/333
2014/0314457 A1 * 10/2014 Kikuchi G03G 15/2053 399/329

* cited by examiner

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(57) **ABSTRACT**

A fixing device of an exemplary embodiment includes a fixing belt, an induced current generation section, a first auxiliary heat generation section, and a second auxiliary heat generation section. The fixing belt includes a conductive layer. The induced current generation section opposes the fixing belt in a thickness direction. The induced current generation section performs electromagnetic induction heating on the conductive layer. The first auxiliary heat generation section opposes the induced current generation section with the fixing belt interposed therebetween. The first auxiliary heat generation section opposes a sheet passing region of the fixing belt in a width direction and contains ferrite. The second auxiliary heat generation section opposes the induced current generation section with the fixing belt interposed therebetween. The second auxiliary heat generation section opposes a sheet non-passing region of the fixing belt in the width direction and contains a magnetic material.

14 Claims, 6 Drawing Sheets

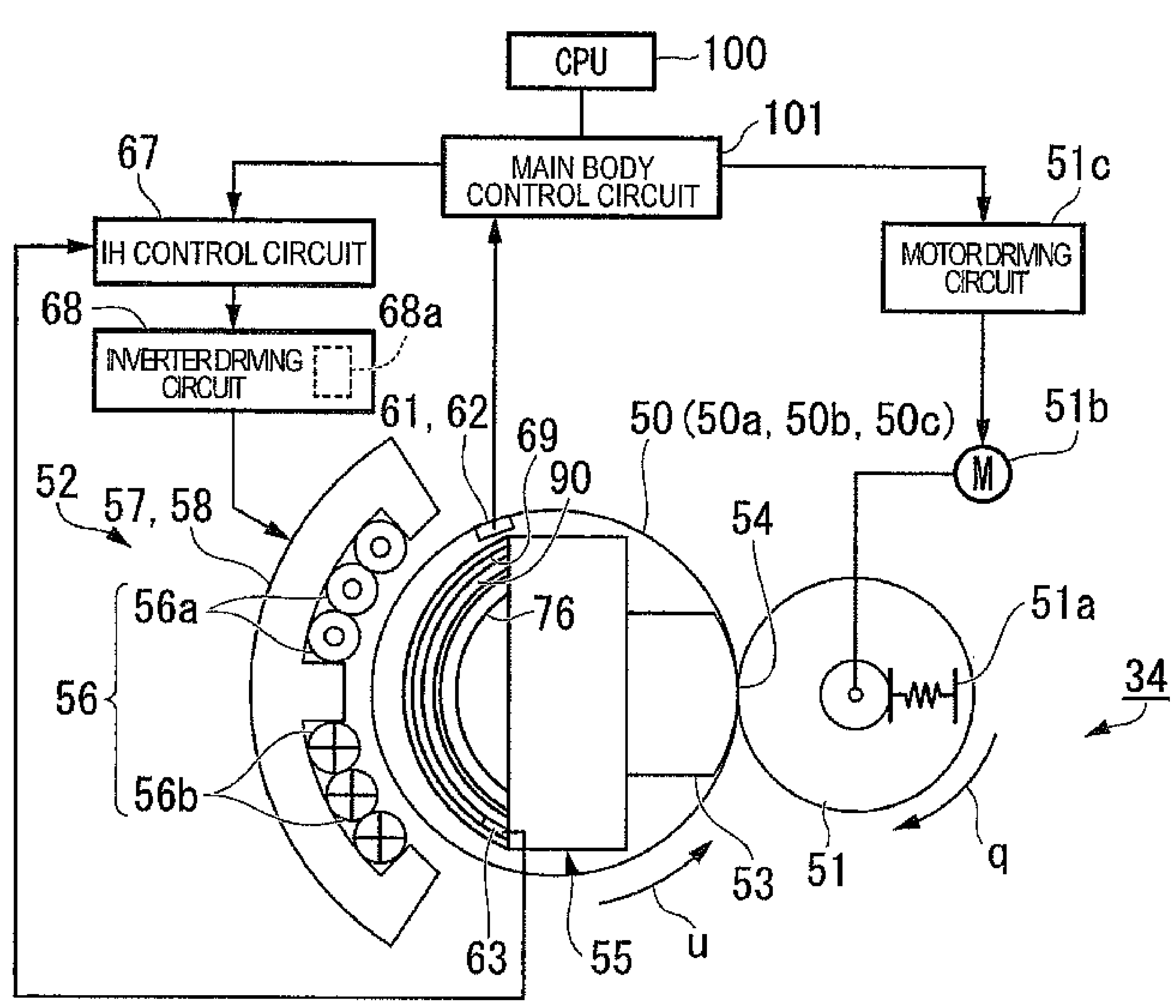
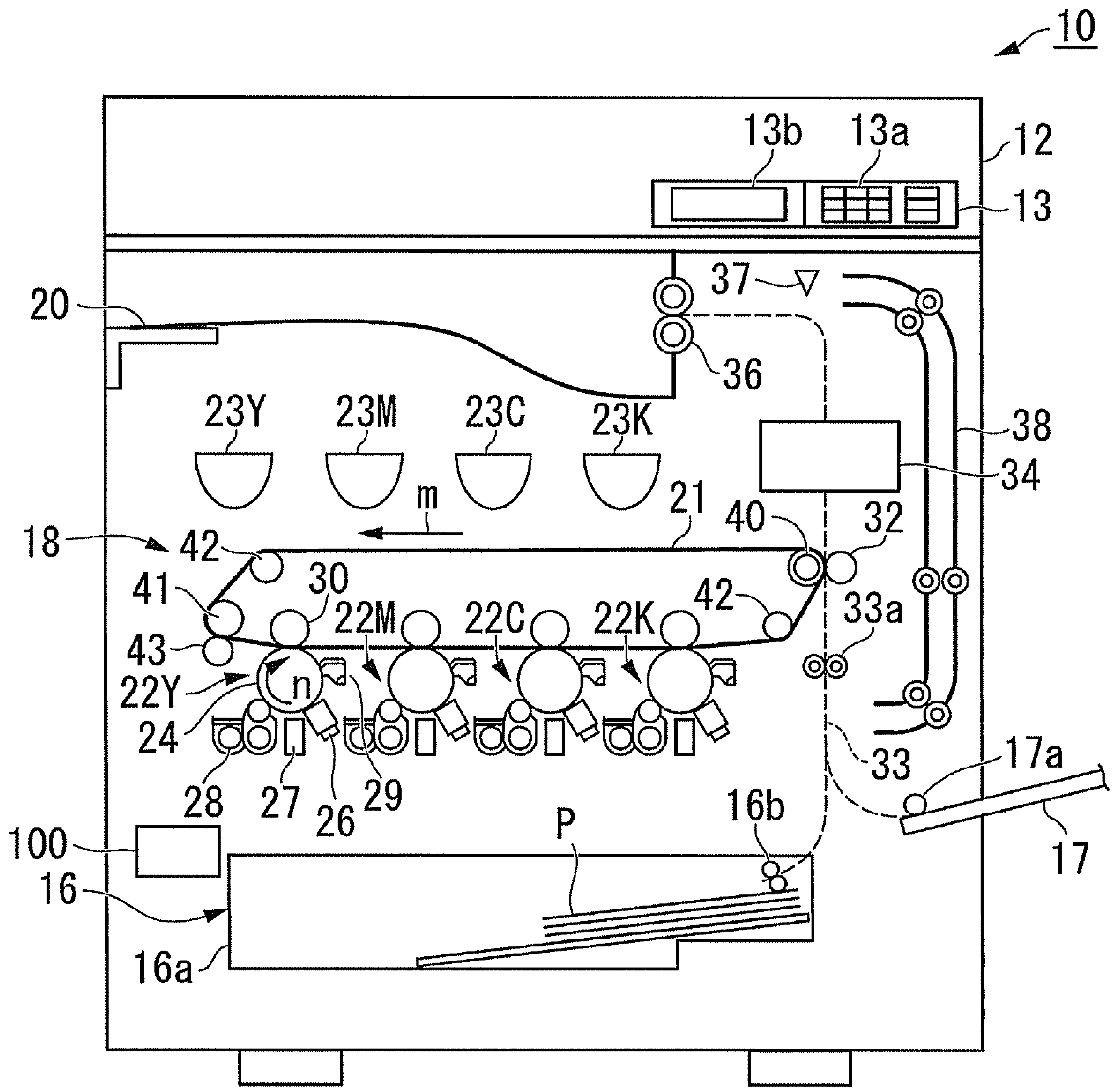


FIG. 1


10
12
13b
13a
13
20
37
36
38
34
23Y
23M
23C
23K
m
21
40
32
18
42
41
30
22M
22C
22K
42
33a
43
22Y
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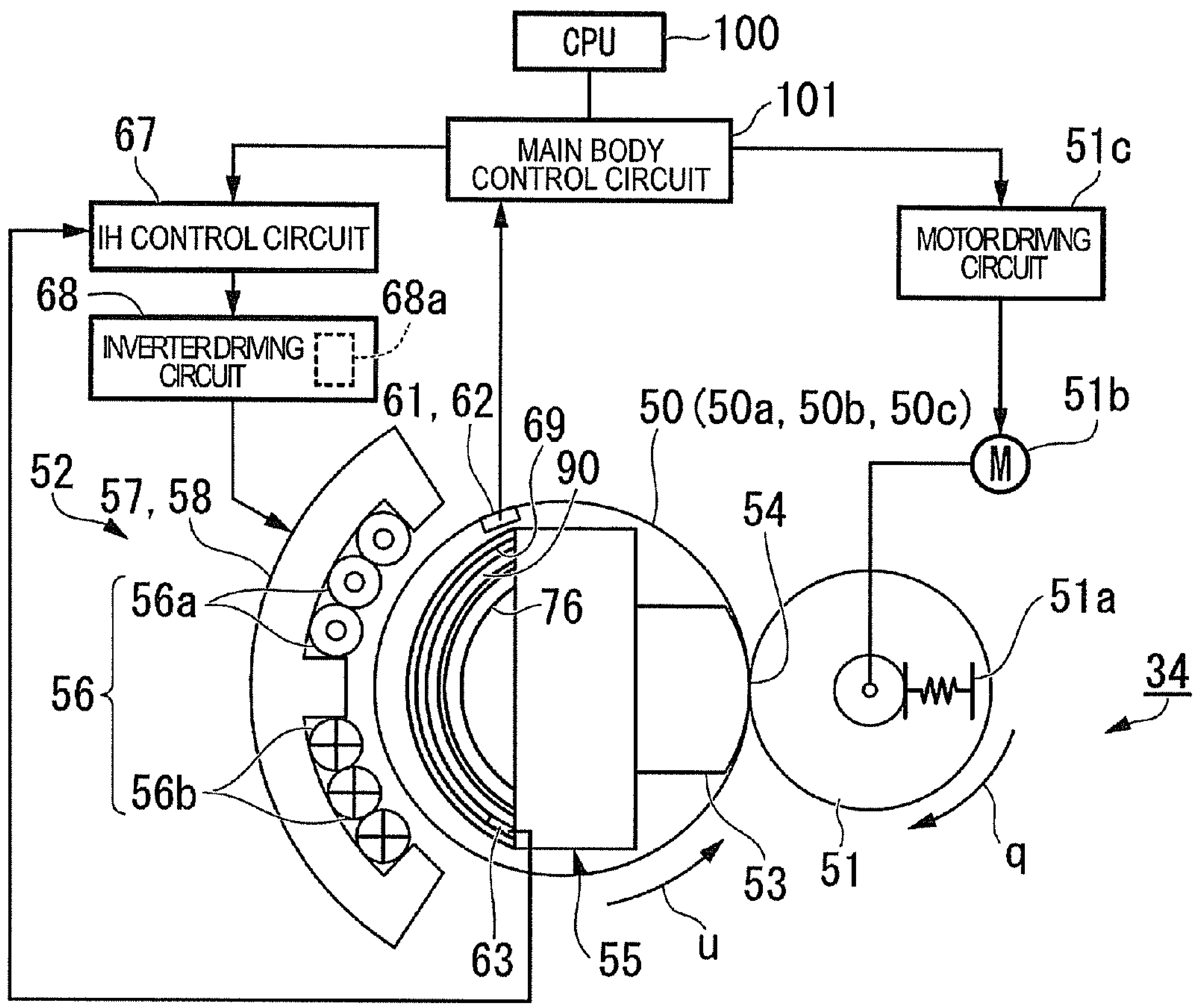
24
33
17a
28
27
26
29
16b
100
P
17
16
16a

FIG. 2



CPU
100
101
MAIN BODY CONTROL CIRCUIT
67
IH CONTROL CIRCUIT
51c
MOTOR DRIVING CIRCUIT
68
68a
INVERTER DRIVING CIRCUIT
61, 62
69
90
50 (50a, 50b, 50c)
51b
M
52
57, 58
54
56a
76
51a
56
34
56b
63
55
u
53
51
q

FIG. 3

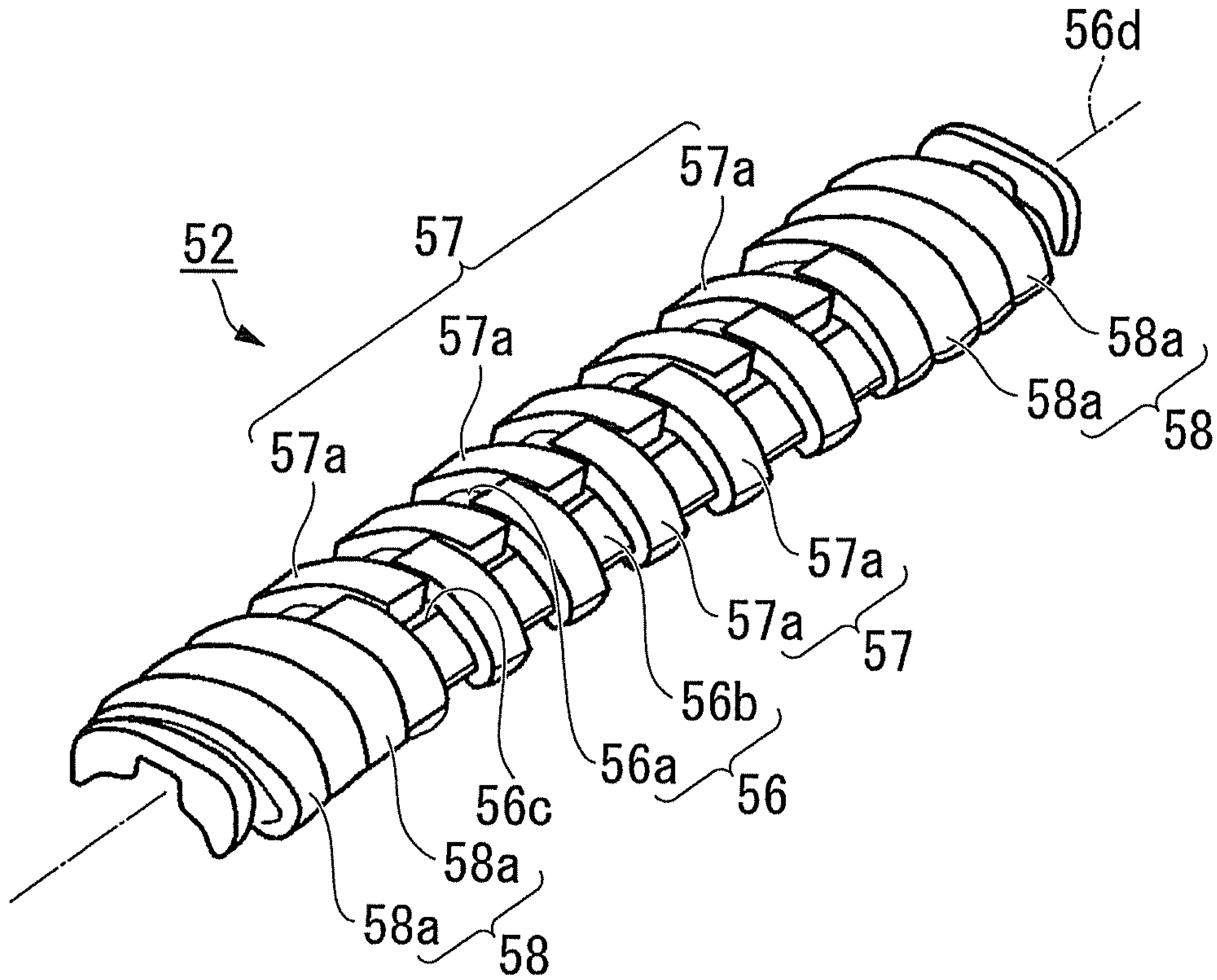

56d
57a
52
57
57a
58a
58a
58
57a
57a
57a
57
56b
56a
56
56c
58a
58a
58

FIG. 4

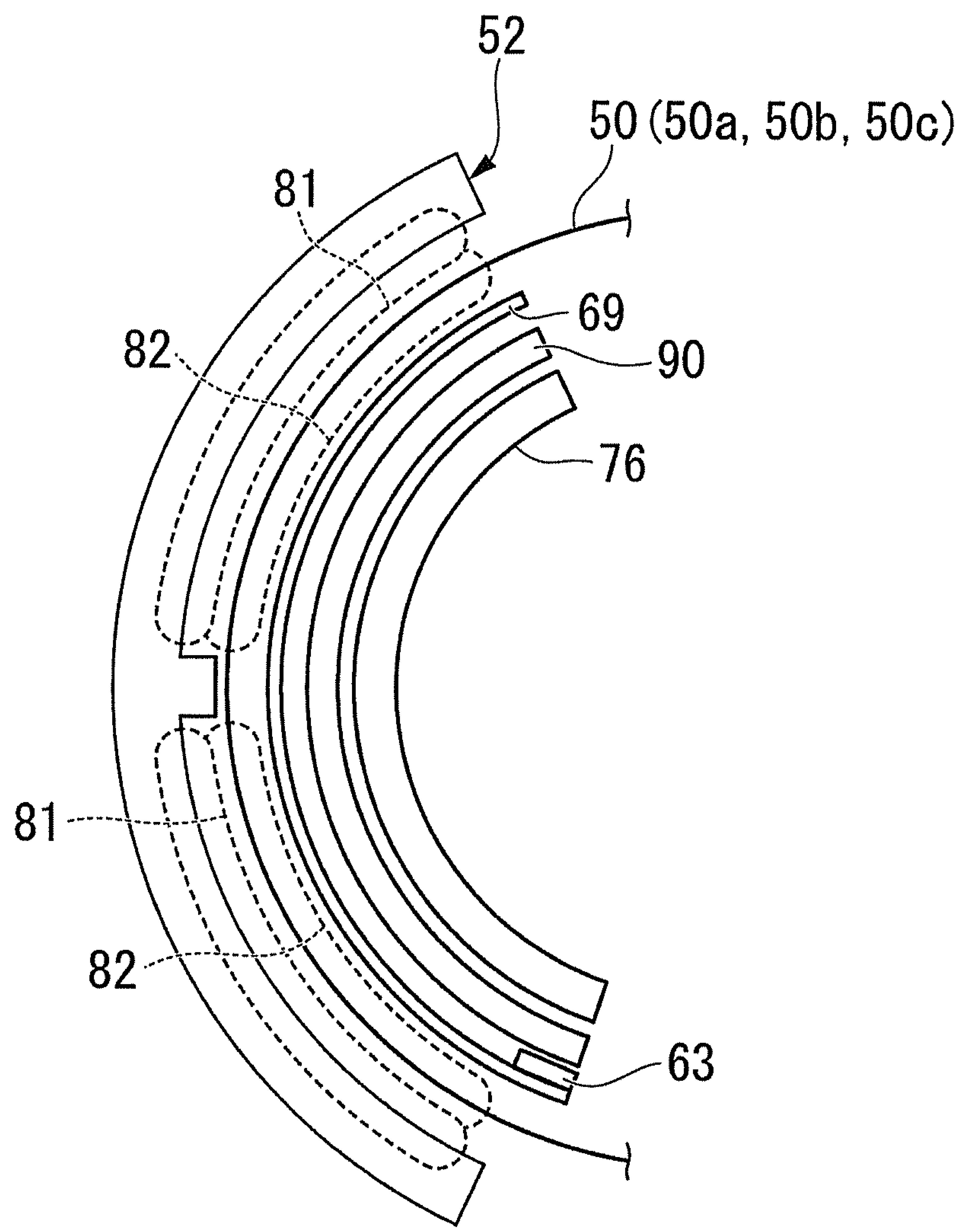
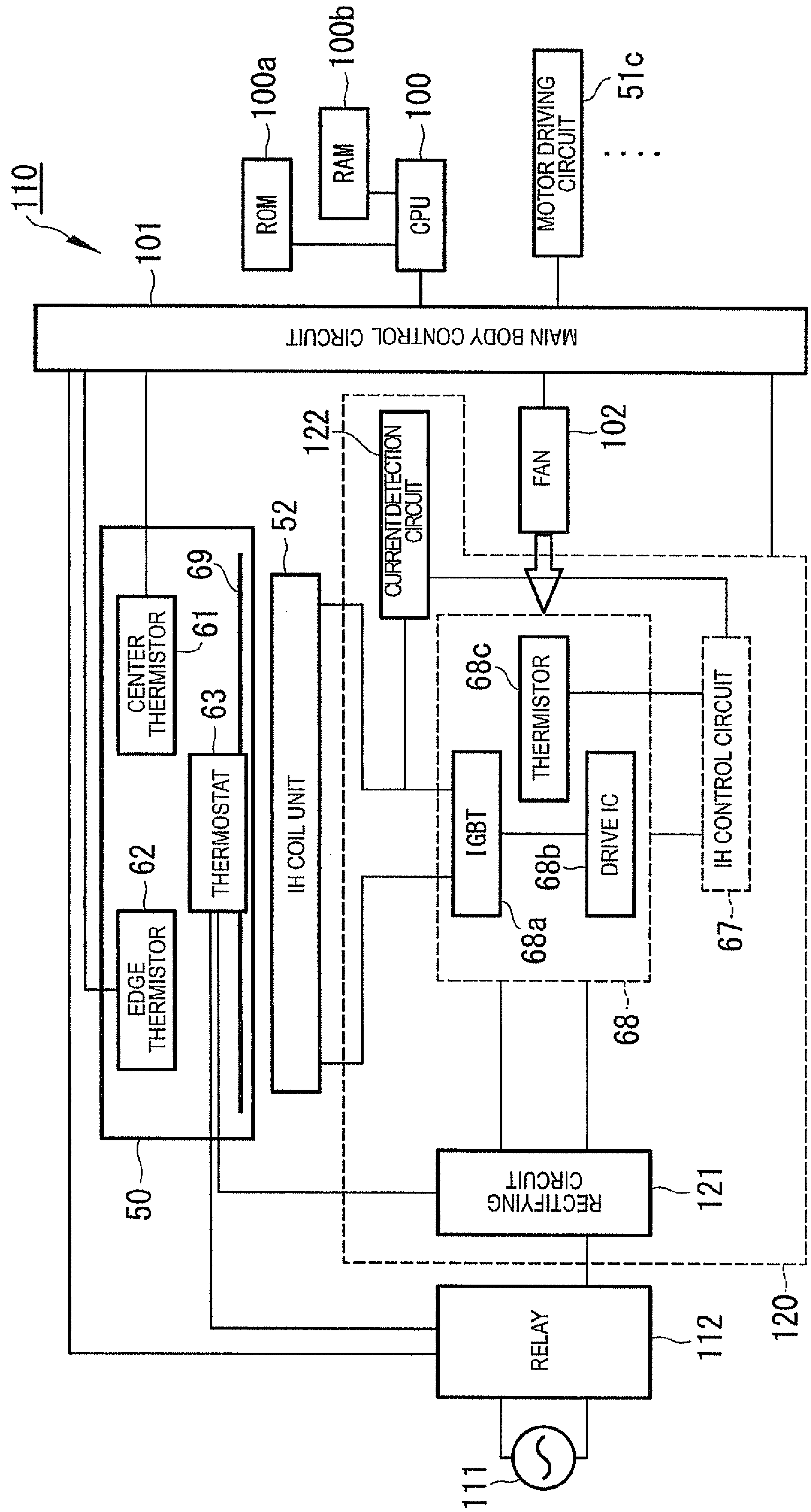


FIG. 5



110
101
MAIN BODY CONTROL CIRCUIT
ROM
100a
RAM
100b
CPU
100
MOTOR DRIVING CIRCUIT
51c
CENTER THERMISTOR
61
69
63
THERMOSTAT
EDGE THERMISTOR
62
50
IH COIL UNIT
52
122
CURRENT DETECTION CIRCUIT
FAN
102
68c
THERMISTOR
IGBT
68a
DRIVE IC
68b
68
IH CONTROL CIRCUIT
67
RECTIFYING CIRCUIT
121
RELAY
112
111
120

FIG. 6

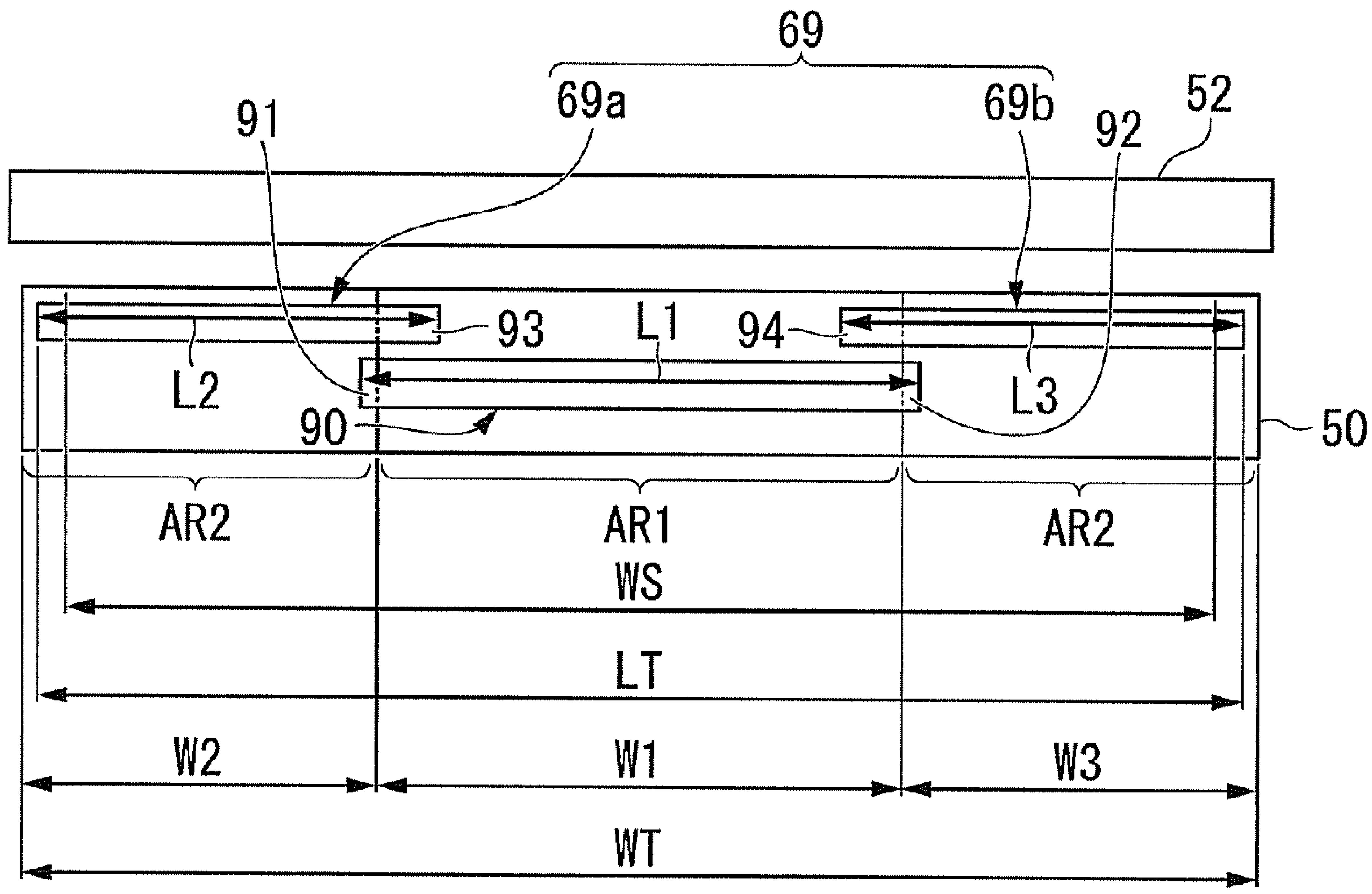
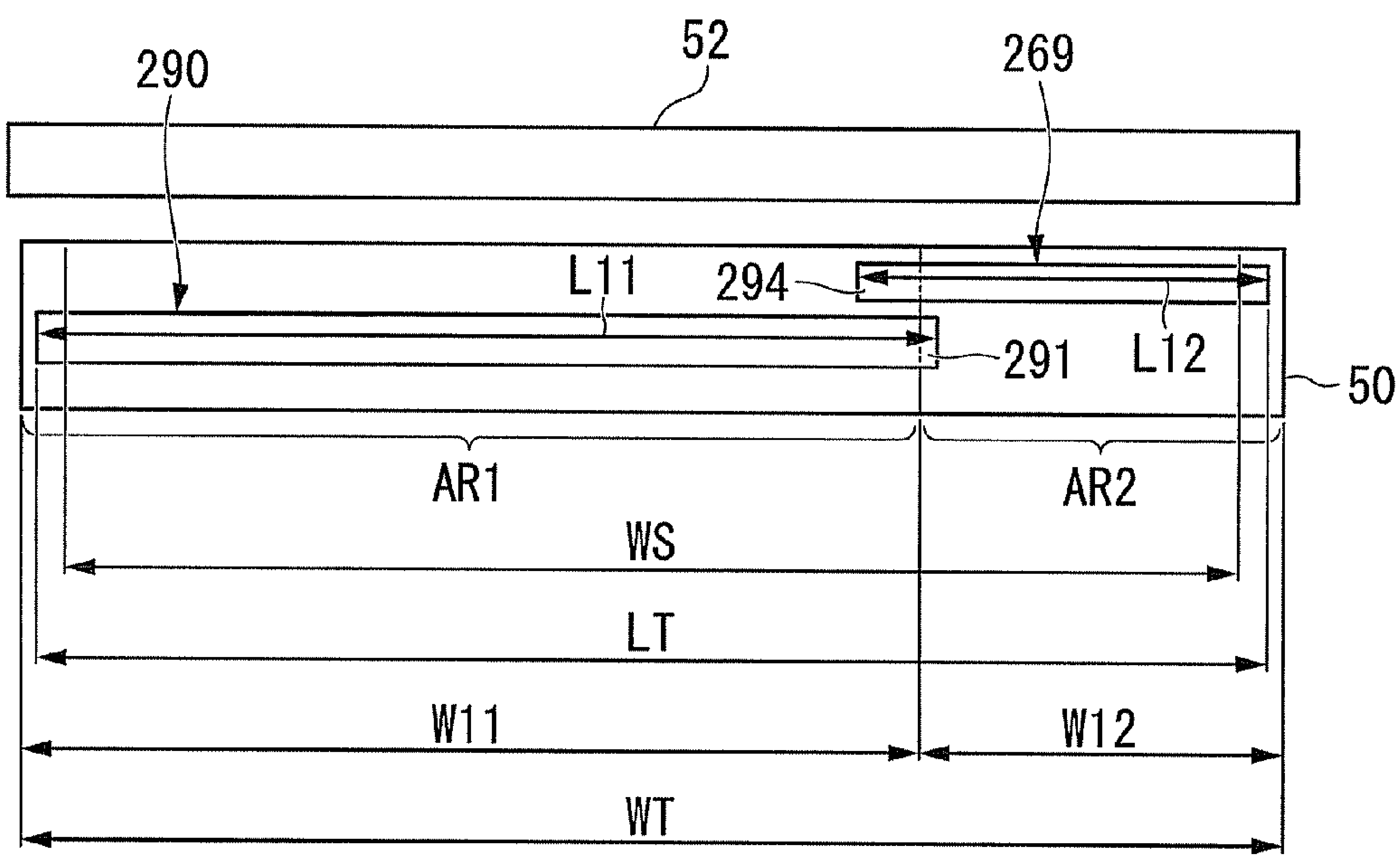

69
69a
69b
91
92
52
93
L1
94
L2
L3
90
50
AR2
AR1
AR2
WS
LT
W2
W1
W3
WT

FIG. 7


290
52
269
L11
294
291
L12
50
AR1
AR2
WS
LT
W11
W12
WT

FIXING DEVICE

FIELD

Embodiments described herein relate generally to a fixing device.

BACKGROUND

In recent years, there are image forming apparatuses such as a multi-function peripheral (hereinafter, referred to as an "MFP") and a printer. The image forming apparatus includes a fixing device. The fixing device heats a conductive layer of a fixing belt by using an electromagnetic induction heating method (hereinafter, referred to as an "IH" method). The fixing device fixes a toner image to a recording medium with heat of the fixing belt. An auxiliary heat generation section concentrates magnetic flux during electromagnetic induction heating so as to increase an amount of generated heat in the fixing belt. The auxiliary heat generation section is formed of a magnetic shunt alloy. Magnetic characteristics of the magnetic shunt alloy change depending on a temperature. The magnetic shunt alloy transitions from a ferromagnet to a paramagnet with the Curie point as a boundary. The magnetic shunt alloy generates heat by itself. If the magnetic shunt alloy generates heat by itself, an internal temperature of the fixing belt increases. If the internal temperature of the fixing belt increases, a thermostat of the fixing belt may cause operation errors.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side view of an image forming apparatus according to a first exemplary embodiment.

FIG. **2** is a side view of a fixing device including a control block of an IH coil unit.

FIG. **3** is a perspective view of the IH coil unit.

FIG. **4** is a diagram illustrating magnetic paths directed to a fixing belt and first and second auxiliary heat generation plates by magnetic flux from the IH coil unit.

FIG. **5** is a block diagram illustrating a control system which mainly controls the IH coil unit.

FIG. **6** is a diagram illustrating an arrangement of the first auxiliary heat generation plate, the second auxiliary heat generation plate, the fixing belt, and the IH coil unit.

FIG. **7** is a diagram illustrating an arrangement of a first auxiliary heat generation plate, a second auxiliary heat generation plate, the fixing belt, and the IH coil unit according to a second exemplary embodiment.

DETAILED DESCRIPTION

A fixing device of an exemplary embodiment includes a fixing belt, an induced current generation section, a first auxiliary heat generation section, and a second auxiliary heat generation section. The fixing belt includes a conductive layer. The induced current generation section opposes the fixing belt in a thickness direction. The induced current generation section performs electromagnetic induction heating on the conductive layer. The first auxiliary heat generation section opposes the induced current generation section with the fixing belt interposed therebetween. The first auxiliary heat generation section opposes a sheet passing region of the fixing belt in a width direction. The first auxiliary heat generation section contains ferrite. The second auxiliary heat generation section opposes the induced current generation section with the fixing belt interposed therebetween. The second auxiliary heat generation section opposes a sheet non-passing region of the fixing belt in the width direction. The second auxiliary heat generation section contains a magnetic material.

Hereinafter, an image forming apparatus **10** of a first exemplary embodiment will be described with reference to the drawings. In the respective drawings, the same constituent elements are given the same reference numeral.

FIG. **1** is a side view of the image forming apparatus **10** according to the first exemplary embodiment. Hereinafter, an MFP **10** will be described as an example of the image forming apparatus **10**.

As illustrated in FIG. **1**, the MFP **10** includes a scanner **12**, a control panel **13**, a paper feeding cassette unit **16**, a paper feeding tray **17**, a printer unit **18**, and a paper discharge unit **20**. The MFP **10** includes a CPU **100** which controls the entire MFP **10**. The CPU **100** controls a main body control circuit **101** (refer to FIG. **2**).

The scanner **12** reads an original document image. The control panel **13** includes an input key **13*a*** and a display portion **13*b***. For example, the input key **13*a*** receives an input operation from a user. For example, the display portion **13*b*** is of a touch panel type. The display portion **13*b*** receives an input operation from the user and performs corresponding display to the user.

The paper feeding cassette unit **16** includes a paper feeding cassette **16*a*** and pickup rollers **16*b***. The paper feeding cassette **16*a*** stores a sheet P which is a recording medium. The pickup rollers **16*b*** extract the sheet P from the paper feeding cassette **16*a***.

The paper feeding cassette **16*a*** feeds an unused sheet P. The paper feeding tray **17** feeds an unused sheet P with a pickup roller **17*a***.

The printer unit **18** forms an image of the original document image read by the scanner **12**. The printer unit **18** includes an intermediate transfer belt **21**. The printer unit **18** supports the intermediate transfer belt **21** with a backup roller **40**, a driven roller **41**, and a tension roller **42**. The backup roller **40** includes a driving portion (not illustrated). The printer unit **18** rotates the intermediate transfer belt **21** in a direction of an arrow m.

The printer unit **18** includes four sets of image forming stations **22**Y, **22**M, **22**C and **22**K. The image forming stations **22**Y, **22**M, **22**C and **22**K are used to respectively form yellow (Y), magenta (M), cyan (C) and black (K) images. The image forming stations **22**Y, **22**M, **22**C and **22**K are disposed in parallel in the rotation direction of the intermediate transfer belt **21** below the intermediate transfer belt **21**.

The printer unit **18** includes cartridges **23**Y, **23**M, **23**C and **23**K over the image forming stations **22**Y, **22**M, **22**C and **22**K. The cartridges **23**Y, **23**M, **23**C and **23**K respectively store yellow (Y), magenta (M), cyan (C) and black (K) toner particles to be supplied.

Hereinafter, among the image forming stations **22**Y, **22**M, **22**C and **22**K, the yellow (Y) image forming station **22**Y will be described later as an example. The image forming stations **22**M, **22**C and **22**K have the same configurations as a configuration of the image forming station **22**Y, and thus detailed description thereof will be omitted.

The image forming station **22**Y includes an electrostatic charger **26**, an exposure scanning head **27**, a developing device **28**, and a photoconductor cleaner **29**. The electrostatic charger **26**, the exposure scanning head **27**, the developing device **28**, and the photoconductor cleaner **29** are disposed around a photoconductive drum **24** which is rotated in an arrow n direction.

The image forming station **22**Y includes a primary transfer roller **30**. The primary transfer roller **30** opposes the photoconductive drum **24** with the intermediate transfer belt **21** interposed therebetween.

In the image forming station **22**Y, the photoconductive drum **24** is charged by the electrostatic charger **26** and is then exposed to light by the exposure scanning head **27**. The image forming station **22**Y forms an electrostatic latent image on the photoconductive drum **24**. The developing device **28** develops the electrostatic latent image on the photoconductive drum **24** by using a developer containing two components including toner and carriers.

The primary transfer roller **30** primarily transfers a toner image formed on the photoconductive drum **24** onto the intermediate transfer belt **21**. The image forming stations **22**Y, **22**M, **22**C and **22**K form a color toner image on the intermediate transfer belt **21** by using the primary transfer roller **30**. The color toner image is formed by sequentially overlapping yellow (Y), magenta (M), cyan (C) and black (K) toner images on each other. The photoconductor cleaner **29** removes toner remaining on the photoconductive drum **24** after the primary transfer.

The printer unit **18** includes a secondary transfer roller **32**. The secondary transfer roller **32** opposes the backup roller **40** with the intermediate transfer belt **21** interposed therebetween. The secondary transfer roller **32** secondarily transfers the color toner image on the intermediate transfer belt **21** onto the sheet P. The sheet P is fed from the paper feeding cassette unit **16** or the manual paper feeding tray **17** along a transport path **33**.

The printer unit **18** includes a belt cleaner **43** which opposes the driven roller **41** via the intermediate transfer belt **21**. The belt cleaner **43** removes toner remaining on the intermediate transfer belt **21** after the secondary transfer. In addition, an image forming portion includes the intermediate transfer belt **21**, the four sets of image forming stations (**22**Y, **22**M, **22**C and **22**K), and the secondary transfer roller **32**.

The printer unit **18** includes resist rollers **33***a*, a fixing device **34** (a fixing section), and paper discharge rollers **36** along the transport path **33**. The printer unit **18** includes a branching portion **37** and a reverse transport portion **38** on the downstream side of the fixing device **34**. The branching portion **37** forwards the sheet P after undergoing fixation to the paper discharge unit **20** or the reverse transport portion **38**. In a case of duplex printing, the reverse transport portion **38** reverses and transports the sheet P which is sent from the branching portion **37**, in the direction of the resist rollers **33***a*. The MFP **10** forms a fixed toner image on the sheet P in the printer unit **18**. The MFP **10** discharges the sheet P on which the fixed toner image is formed to the paper discharge unit **20**.

The MFP **10** is not limited to a tandem developing method. In the MFP **10**, the number of developing device **28** is not limited thereto either. The MET **10** may direct transfer a toner image onto the sheet P from the photoconductive drum **24**.

Hereinafter, the fixing device **34** will be described in detail.

FIG. **2** is a side view of the fixing device **34** including a control block of an electromagnetic induction heating coil unit **52** according to the first exemplary embodiment. The electromagnetic induction heating coil unit is referred to as an "IH coil unit".

As illustrated in FIG. **2**, the fixing device **34** includes a fixing belt **50**, a press roller **51**, the IH coil unit **52**, a first auxiliary heat generation plate **90**, and a second auxiliary heat generation plate **69**.

The fixing belt **50** is a tubular endless belt. An internal belt mechanism **55** which supports a nip pad **53** and the first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** is disposed on an inner circumferential side of the fixing belt **50**.

The fixing belt **50** is rotated in an arrow u direction by following a press roller **51**. Alternatively, the fixing belt **50** may be rotated in the arrow u direction separately from the press roller **51**. If the fixing belt **50** and the press roller **51** are rotated separately from each other, a one-way clutch may be provided so that a speed difference between the fixing belt **50** and the press roller **51** is not generated.

In the fixing belt **50**, a heat generation layer **50***a* (conductive layer) which is a heat generation portion and a release layer **50***c* are sequentially laminated on a base layer **50***b*. In addition, a layer structure of the fixing belt **50** is not limited thereto as long as the fixing belt **50** includes the heat generation layer **50***a*.

For example, the base layer **50***b* is made of a polyimide resin (PI). For example, the heat generation layer **50***a* is made of a nonmagnetic metal such as copper (Cu). For example, the release layer **50***c* is made of a fluororesin such as a tetrafluoroethylene-perfluoroalkyl vinyl ether copolymer resin (PFA).

In the fixing belt **50**, in order to realize rapid warming-up, the heat generation layer **50***a* is thinned so as to reduce the heat capacity. The fixing belt **50** having the small heat capacity reduces the time required in warming-up. Energy consumption is reduced by reducing the time required in the warming-up.

For example, in the fixing belt **50**, a thickness of the copper layer of the heat generation layer **50***a* is 10 μm in order to reduce the heat capacity. For example, the heat generation layer **50***a* is covered by a protective layer such as nickel. The protective layer such as nickel prevents oxidation of the copper layer. The protective layer such as nickel improves mechanical strength of the copper layer.

The heat generation layer **50***a* may be formed on the base layer **50***b* made of a polyimide resin through electroless nickel plating and copper plating. Through the electroless nickel plating, adhesion strength between the base layer **50***b* and the heat generation layer **50***a* is improved. Through the electroless nickel plating, mechanical strength of the heat generation layer **50***a* is improved.

A surface of the base layer **50***b* may be roughened through sand blasting or chemical etching. Since the surface of the base layer **50***b* is roughened, adhesion strength between the base layer **50***b* and the plated nickel of the heat generation layer **50***a* is further mechanically improved.

A metal such as titanium (Ti) may be dispersed into the polyimide resin forming the base layer **50***b*. If a metal is dispersed into the base layer **50***b*, adhesion strength between the base layer **50***b* and the plated nickel of the heat generation layer **50***a* is further improved.

The heat generation layer **50***a* may be made of, for example, nickel, iron (Fe), stainless steel, aluminum (Al), and silver (Ag). The heat generation layer **50***a* may employ two or more kinds of alloys, and may employ two or more kinds of layered metals which overlap each other.

In the heat generation layer **50***a*, an eddy current is generated by magnetic flux which is generated by the IH coil unit **52**. The heat generation layer **50***a* generate Joule heat by using the eddy current and electric resistance of the heat generation layer **50***a* so as to heat the fixing belt **50**.

FIG. **3** is a perspective view of the IH coil unit **52** according to the first exemplary embodiment.

As illustrated in FIG. **3**, the IH coil unit **52** includes a coil **56**, a first core **57**, and second cores **58**.

The coil **56** generates magnetic flux when a high frequency current is applied thereto. The coil **56** opposes the fixing belt

50 in a thickness direction. A longitudinal direction of the coil **56** matches a width direction (hereinafter, referred to as a "belt width direction") of the fixing belt **50**.

The first core **57** and the second cores **58** cover an opposite side (hereinafter, referred to as a "rear surface side") of the coil **56** to the fixing belt **50**. The first core **57** and the second cores **58** prevent the magnetic flux generated by the coil **56** from leaking out of the rear surface side. The first core **57** and the second cores **58** cause the magnetic flux from the coil **56** to concentrate on the fixing belt **50**.

The first core **57** includes a plurality of one-wing portions **57***a*. The plurality of one-wing portions **57***a* are alternately disposed in a zigzag form so as to form axial symmetry with respect to a central line **56***d* lying in the longitudinal direction of the coil **56**.

The second cores **58** are disposed on both sides of the first core **57** in the longitudinal direction. Each of the second cores **58** includes a plurality of two-wing portions **58***a* which extend over both wings of the coil **56**.

For example, the one-wing portions **57***a* and the two-wing portions **58***a* are made of magnetic materials such as a nickel-zinc alloy (Ni—Zn) and a manganese-nickel alloy (Mn—Ni).

In the first core **57**, the plurality of one-wing portions **57***a* restrict the magnetic flux generated by the coil **56**. The magnetic flux generated by the coil **56** is alternately restricted every other one-wings of the coil **56** so as to form axial symmetry with respect to the central line **56***d*. In the first core **57**, the plurality of one-wing portions **57***a* cause the magnetic flux from the coil **56** to concentrate on the fixing belt **50**.

In the second cores **58**, the plurality of two-wing portions **58***a* restrict the magnetic flux generated by the coil **56**. The magnetic flux generated by the coil **56** is restricted by both of the wings of the coil **56** on both sides of the first core **57**. In the second cores **58**, the plurality of two-wing portions **58***a* cause the magnetic flux from the coil **56** to concentrate on the fixing belt **50**. The magnetic flux concentration power of the second cores **58** is greater than the magnetic flux concentration power of the first core **57**.

The coil **56** includes a first wing **56***a* and a second wing **56***b*. The first wing **56***a* is disposed on one side with respect to the central line **56***d*. The second wing **56***b* is disposed on the other side with respect to the central line **56***d*. A window portion **56***c* is formed between the first wing **56***a* and the second wing **56***b* and on an inner side of the coil **56** in the longitudinal direction.

As illustrated in FIG. **2**, the IH coil unit **52** generates an inducted current while the fixing belt **50** is rotated in the arrow u direction. The heat generation layer **50***a* of the fixing belt **50** opposing the IH coil unit **52** generates heat due to the induced current.

For example, a litz wire is used as the coil **56**. The litz wire is formed by bundling a plurality of copper wires coated with heat-resistive polyamide-imide which is an insulating material. The coil **56** is formed by winding a conductive coil.

The coil **56** generates magnetic flux when a high frequency current is applied thereto by an inverter driving circuit **68**. For example, the inverter driving circuit **68** includes an insulated gate bipolar transistor (IGBT) element **68***a*.

Each of the first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** is formed in an arc shape along the inner circumferential surface of the fixing belt **50**. The first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** oppose the first wing **56***a* and the second wing **56***b* of the coil **56** via the fixing belt **50**. The first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** cause an eddy current due to the magnetic flux generated by the IH coil unit **52** so as to generate heat. The first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** assist the IH coil unit **52** with heat generation from the heat generation layer **50***a* of the fixing belt **50**. The first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** assist heating of the fixing belt **50**.

The first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** are disposed in a region surrounded by the fixing belt **50**. The first auxiliary heat generation plate **90** is disposed further toward the inside of the fixing belt **50** in a diameter direction than the second auxiliary heat generation plate **69**. The second auxiliary heat generation plate **69** is closer to the inner circumferential surface of the fixing belt **50** than the first auxiliary heat generation plate **90**. The second auxiliary heat generation plate **69** is disposed to be separated from the inner circumferential surface of the fixing belt **50** with a gap therebetween. The second auxiliary heat generation plate **69** is disposed to be separated from the first auxiliary heat generation plate **90** with a gap therebetween.

Hereinafter, surfaces of the first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** on the fixing belt **50** side are referred to as "diameter direction outer surfaces", and surfaces thereof on opposite sides to the fixing belt **50** are referred to as "diameter direction inner surfaces".

For example, a gap between the diameter direction outer surface of the second auxiliary heat generation plate **69** and the inner circumferential surface of the fixing belt **50** is about 1 mm to 2 mm. For, example, a gap between the diameter direction inner surface of the second auxiliary heat generation plate **69** and the diameter direction outer surface of the first auxiliary heat generation plate **90** is about 1 mm to 2 mm. For example, a gap between the diameter direction outer surface of the first auxiliary heat generation plate **90** and the inner circumferential surface of the fixing belt **50** is about 3 mm.

A thickness of the second auxiliary heat generation plate **69** is smaller than a thickness of the first auxiliary heat generation plate **90** in the belt width direction. For example, a thickness of the second auxiliary heat generation plate **69** is about 0.15 mm.

The first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** are supported by a shield **76** on an opposite side to the coil **56**. The shield **76** has the same arc shape as the first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69**. The shield **76** is disposed on an inner circumferential side of the first auxiliary heat generation plate **90**. For example, the shield **76** is made of a nonmagnetic material such as aluminum or copper. The shield **76** shields the magnetic flux from the IH coil unit **52**. The shield **76** prevents the magnetic flux from influencing the nip pad **53** or the like.

The first auxiliary heat generation plate **90** does not generate heat by itself due to an induced current generated by the IH coil unit **52**. For example, the first auxiliary heat generation plate **90** is formed of the following ferrite. The ferrite prompts promotes heat generation of the fixing belt **50** with magnetic flux caused by an induced current. The ferrite does not generate heat by itself even if receiving the magnetic flux caused by the induced current.

The first auxiliary heat generation plate **90** is made of, for example, a Mn—Zn based ferrite. The Mn—Zn based ferrite includes iron oxide (Fe_2O_3), zinc oxide (ZnO), and manganese oxide (MnO).

The second auxiliary heat generation plate **69** is made of a magnetic material. For example, the magnetic material is a magnetic shunt alloy. The magnetic shunt alloy which is an alloy of iron and nickel has a Curie point of 220° C. to 230° C. The magnetic shunt alloy is a thin metal member. If the Curie point is exceeded, the second auxiliary heat generation plate **69** has a weakened magnetic force, and thus heating assistance of the fixing belt **50** is weakened. Since the second auxiliary heat generation plate **69** is made of the magnetic shunt alloy, the fixing belt **50** is heated within a range of heat resistance temperatures. Magnetic characteristics of the magnetic shunt alloy change depending on a temperature. The magnetic shunt alloy transitions from a ferromagnet to a paramagnet with the Curie point as a boundary. The magnetic shunt alloy generates heat by itself. The magnetic shunt alloy has weakened magnetism with the Curie point as a boundary, and thus heating assistance of the fixing belt **50** is weakened.

The first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** may be provided with a plurality of slits perpendicular to a direction of a current induced by the IH coil unit **52**. If the first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** are provided with the plurality of slits, an eddy current generated in the first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** is divided thereby. In other words, the eddy current generated in the first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** becomes an eddy occurring between the slits. Since the first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** are provided with the plurality of slits, a size of an eddy occurring between the slits can be reduced more than if the first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** are not provided with the plurality of slits. As a result of the size of the eddy occurring between the slits being reduced, heat generation of the first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** can be reduced.

The first auxiliary heat generation plate **90** may be closer to the inner circumferential surface of the fixing belt **50** than to the second auxiliary heat generation plate **69**. The first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** may be in contact with the inner circumferential surface of the fixing belt **50**.

Both ends with an arc shape of each of the first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** are supported by the internal belt mechanism **55**. For example, the internal belt mechanism **55** may cause the first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** to approach and separate from the fixing belt **50**. For example, the first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** may separate from the fixing belt **50** before warming up the fixing device **34**, and may approach the fixing belt **50** after warming up the fixing device **34**.

FIG. **4** is a diagram illustrating magnetic paths directed to the fixing belt **50** and the first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** by magnetic flux from the IH coil unit **52** according to the first exemplary embodiment. In FIG. **4**, for convenience, the coil **56** and the like are not illustrated.

As illustrated in FIG. **4**, magnetic flux generated by the IH coil unit **52** forms a first magnetic path **81** induced in the heat generation layer **50***a* of the fixing belt **50**. The magnetic flux generated by the IH coil unit **52** forms a second magnetic path **82** induced in the first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69**.

The first auxiliary heat generation plate **90** (ferrite) does not generate heat due to the magnetic flux generated by the IH coil unit **52**. Here, generation of no heat includes a case where an amount of heat generated by the ferrite is very small and can thus be disregarded. For example, a temperature increase when the ferrite generated heat by itself was checked through the test, but the temperature was below 1° C. The second auxiliary heat generation plate **69** (the magnetic shunt alloy) generates heat due to the magnetic flux generated by the IH coil unit **52**. The first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** assist the heat generation layer **50***a* of the fixing belt **50** in generating heat as a result of the second magnetic path **82** being formed. The first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** assist the heat generation layer **50***a* of the fixing belt **50** in generating heat during printing. A fixation temperature is maintained by assisting the heat generation layer **50***a* of the fixing belt **50** in generating heat.

As illustrated in FIG. **2**, the nip pad **53** is a pressing portion which presses the inner circumferential surface of the fixing belt **50** toward the press roller **51** side. A nip **54** is formed between the fixing belt **50** and the press roller **51**.

For example, the nip pad **53** is made of an elastic material such as silicon rubber or a fluororubber. The nip pad **53** may be made of a heat resistive resin such as a polyimide resin (PI), a polyphenylene sulfide resin (PPS), a polyether sulfone resin (PES), liquid crystal polymer (LCP), orphenol resin (PF).

For example, a sheet-like friction reducing member is disposed between the fixing belt **50** and the nip pad **53**. The friction reducing member is formed of, for example, a sheet member or a release layer which is favorably slid and has good abrasion resistance. The friction reducing member is fixedly supported by the internal belt mechanism **55**. The friction reducing member is slidably in contact with the inner circumferential surface of the traveling fixing belt **50**. The friction reducing member may be formed of the following lubricious sheet member. The sheet member may be formed of a glass fiber sheet impregnated with a fluororesin.

The press roller **51** includes a heat resistive silicon sponge, a silicon rubber layer, or the like around its core. For example, a release layer is disposed on a surface of the press roller **51**. The release layer is made of a fluororesin such as a PFA resin. The press roller **51** presses the fixing belt **50** with a pressing mechanism **51***a*. The press roller **51** is a pressing portion which presses the fixing belt **50** along with the nip pad **53**. The press roller **51** is rotated in an arrow q direction by a motor **51***b*. The motor **51***b* is driven by a motor driving circuit **51***c* which is controlled by the main body control circuit **101**.

A center thermistor **61**, an edge thermistor **62**, and a thermostat **63** are disposed in a region surrounded by the fixing belt **50**.

The center thermistor **61** and the edge thermistor **62** detect a temperature of the fixing belt **50**. The center thermistor **61** and the edge thermistor **62** output a detection result of the temperature of the fixing belt **50** to the main body control circuit **101**. The center thermistor **61** is disposed at a center of the fixing belt **50** in the belt width direction.

The edge thermistor **62** is disposed further outward than the IH coil unit **52** in the belt width direction. The edge thermistor **62** detects a temperature of an outer part of the fixing belt **50** in the belt width direction with high accuracy without being influenced by the IH coil unit **52**.

The main body control circuit **101** controls an IH control circuit **67** according to detection results from the center thermistor **61** and the edge thermistor **62**. The IH control circuit **67** controls a high frequency current output from the inverter driving circuit **68** under the control of the main body control circuit **101**. The fixing belt **50** is maintained in various control temperature ranges in accordance with an output from the inverter driving circuit **68**.

The thermostat **63** functions as a safety device of the fixing device **34**. The thermostat **63** operates if the fixing belt **50** or the second auxiliary heat generation plate **69** abnormally generates heat and thus a temperature thereof increases to a cut-off threshold value. If the thermostat **63** operates, a current does not flow to the IH coil unit **52**. The MET **10** stops its operation if a current does not flow to the IH coil unit **52**. The MFP **10** stops its operation and thus abnormal heat generation from the fixing device **34** is prevented.

Hereinafter, main portions of the fixing device **34** according to the first exemplary embodiment will be described with reference to FIG. **6**.

FIG. **6** is a diagram illustrating an arrangement of the first auxiliary heat generation plate **90**, the second auxiliary heat generation plate **69**, the fixing belt **50**, and the IH coil unit **52** according to the first exemplary embodiment.

As illustrated in FIG. **6**, the first auxiliary heat generation plate **90** is located at the center of the fixing belt **50** in the belt width direction. The second auxiliary heat generation plate **69** includes a first division portion **69***a* and a second division portion **69***b*. The first division portion **69***a* is located at a first end of both ends of the fixing belt **50** in the belt width direction. The second division portion **69***b* is located at a second end of both ends of the fixing belt **50** in the belt width direction.

Hereinafter, a region AR**1** through which the sheet P passes is referred to as a "sheet passing region", and a region AR**2** through which the sheet P does not pass is referred to as a "sheet non-passing region". A length W**1** of the sheet passing region AR**1** in the belt width direction is referred to as a "sheet passing region width". In addition, a length W**2** of the sheet non-passing region AR**2** located at the first end in the belt width direction is referred to as a "first sheet non-passing region width". Further, a length W**3** of the sheet non-passing region AR**2** located at the second end in the belt width direction is referred to as a "second sheet non-passing region width". The greatest length WS of the sheet P in the belt width direction in the sheet P to be used is referred to as a "great sheet width".

For example, the sheet passing region width W**1** is set to the same size as a short side width (hereinafter, referred to as an "A4R width") of A4 paper. For example, the sheet non-passing region AR**2** is a region through which A4R does not pass. For example, the great sheet width WS is set to the same size as a short side width of A3 paper. A width WT (hereinafter, referred to as a "belt width") of the fixing belt **50** is a size obtained by adding the sheet passing region width W**1**, the first sheet non-passing region width W**2**, and the third sheet non-passing region width W**3** together. The belt width WT is greater than the great sheet width WS.

The first auxiliary heat generation plate **90** opposes the sheet passing region AR**1**. The second auxiliary heat generation plate **69** opposes the sheet non-passing region AR**2**.

An end of the first auxiliary heat generation plate **90** on the sheet non-passing region AR**2** side and an end of the second auxiliary heat generation plate **69** on the sheet passing region. AR**1** side overlap each other when viewed from the thickness direction of the fixing belt **50**. The end of the first auxiliary heat generation plate **90** on the sheet non-passing region AR**2** side and ends of the first division portion **69***a* and the second division portion **69***b* on the sheet passing region AR**1** side overlap each other when viewed from the thickness direction of the fixing belt **50**.

Hereinafter, the entire length LT of the first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** in the belt width direction is referred to as the "entire auxiliary heat generation plate width". A length L**1** of the first auxiliary heat generation plate **90** in the belt width direction is referred to as a "first auxiliary heat generation plate width". A length L**2** of the first division portion **69***a* in the belt width direction is referred to as a "first division portion width". A length L**3** of the second division portion **69***b* in the belt width direction is referred to as a "second division portion width".

The entire auxiliary heat generation plate width LT is greater than the great sheet width S. The entire auxiliary heat generation plate width LT is smaller than the belt width WT.

The first auxiliary heat generation plate width L**1** is greater than the sheet passing region width W**1**. For example, a ratio L**1**/W**1** between the first auxiliary heat generation plate width L**1** and the sheet passing region width W**1** is about 1.0 to 1.2.

The first auxiliary heat generation plate **90** includes a first extending portion **91** and a second extending portion **92**. The first extending portion **91** exceeds the sheet passing region AR**1** and faces the first division portion **69***a*. The second extending portion **92** exceeds the sheet passing region AR**1** and faces the second division portion **69***b*.

Hereinafter, a length of the first extending portion **91** in the belt width direction is referred to as a "first extending portion width". In addition, a length of the second extending portion **92** in the belt width direction is referred to as a "second extending portion width". The first extending portion width and the second extending portion width are the same as each other.

The first division portion width L**2** is greater than the first sheet non-passing region width W**2**. For example, a ratio L**2**/W**2** between the first division portion width L**2** and the first sheet non-passing region width W**2** is about 1.0 to 1.2.

The first division portion **69***a* separates from the first end of the fixing belt **50**. The first division portion **69***a* includes an extension **93**. The extension **93** exceeds the sheet non-passing region AR**2** located at the first end and faces the first auxiliary heat generation plate **90**.

The second division portion width L**3** is greater than the second sheet non-passing region width W**3**. For example, a ratio L**3**/W**3** between the second division portion width L**3** and the second sheet non-passing region width W**3** is about 1.0 to 1.2.

The second division portion **69***b* separates from the second end of the fixing belt **50**. The second division portion **69***b* includes an extension **94**. The extension **94** exceeds the sheet non-passing region AR**2** located at the second end and faces the first auxiliary heat generation plate **90**.

Hereinafter, a length of the extension **93** of the first division portion **69***a* in the belt width direction is referred to as an "extension width of the first division portion". In addition, a length of the extension **94** of the second division portion **69***b* in the belt width direction is referred to as an "extension width of the second division portion". The extension width of the first division portion **69***a* and the extension width of the second division portion **69***b* are the same as each other.

The extension width of the first division portion **69***a* is greater than the first extending portion width of the first auxiliary heat generation plate **90**. The extension width of the second division portion **69***b* is greater than the second extending portion width of the first auxiliary heat generation plate **90**.

The first auxiliary heat generation plate width L**1** may be equal to or smaller than the sheet passing region width W**1**. The first extending portion width may be different from the second extending portion width. The first division portion width L**2** may be smaller than the first sheet non-passing region width W**2**. The first division portion **69***a* may be in contact with the first end of the fixing belt **50**. The second division portion width L**3** may be smaller than the second sheet non-passing region width W**3**. The second division portion **69***b* may be in contact with the second end of the fixing belt **50**. The extension width of the first division portion **69***a* may be different from the extension width of the second division portion **69***b*. The extension width of the first division portion **69***a* may be equal to or smaller than the first extending portion width of the first auxiliary heat generation plate **90**. The extension width of the second division portion **69***b* may be equal to or smaller than the second extending portion width of the first auxiliary heat generation plate **90**.

Hereinafter, a detailed description will be made of a control system **110** of the IH coil unit **52** which causes the fixing belt **50** to generate heat.

FIG. **5** is a block diagram illustrating the control system **110** which mainly controls the IH coil unit **52** according to the exemplary embodiment.

As illustrated in FIG. **5**, the control system **110** includes the CPU **100**, a read only memory (ROM) **100***a*, a random access memory (RAM) **100***b*, the main body control circuit **101**, an IH circuit **120**, the motor driving circuit **51***c*.

In the control system **110**, the IH circuit **120** supplies power to the IH coil unit **52**. The IH circuit **120** includes a rectifying circuit **121**, the IH control circuit **67**, the inverter driving circuit **68**, and a current detection circuit **122**.

A current is input to the IH circuit **120** from an AC power source **111** via a relay **112**. The IH circuit **120** rectifies the input current with the rectifying circuit **121** so as to supply the rectified current to the inverter driving circuit **68**. The relay **112** cuts off a current from the AC power source **111** if the thermostat **63** is stopped. The inverter driving circuit **68** includes a drive IC **68***b* of the IGBT element **68***a*, and a thermistor **68***c*. The thermistor **68***c* detects a temperature of the IGBT element **68***a*. If the thermistor **68***c* detects an increase in the temperature of the IGBT element **68***a*, the main body control circuit **101** drives a fan **102** so as to cool the IGBT element **68***a*.

The IH control circuit **67** controls the drive IC **68***b* on the basis of detection results from the center thermistor **61** and the edge thermistor **62**. The IH control circuit **67** controls the drive IC **68***b* so as to control an output of the IGBT element **68***a*. The current detection circuit **122** sends a detection result of the output of the IGBT element **68***a* to the IH control circuit **67**. The IH control circuit **67** controls the drive IC **68***b* so that constant power is supplied to the coil **56** on the basis of the detection result from the current detection circuit **122**.

Hereinafter, a description will be made of an operation of the fixing device **34** during warming-up.

As illustrated in FIG. **2**, during warming-up, the fixing device **34** rotates the press roller **51** in the arrow q direction so that the fixing belt **50** is driven-rotated in the arrow u direction. The IH coil unit **52** generates magnetic flux on the fixing belt **50** side when the inverter driving circuit **68** applies a high frequency current thereto.

As illustrated in FIG. **4**, the magnetic flux from the IH coil unit **52** induces the first magnetic path **81** which passes through the heat generation layer **50***a* of the fixing belt **50** so that the heat generation layer **50***a* generates heat. The magnetic flux from the IH coil unit **52**, penetrating through the fixing belt **50** induces the second magnetic path **82** which passes through the first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** so that the first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** generate heat. The second magnetic path **82** formed between the heat generation layer **50***a* and the first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** assist heating of the heat generation layer **50***a*.

As illustrated in FIG. **2**, the IH control circuit **67** controls the inverter driving circuit **68** on the basis of a detection result from the center thermistor **61** or the edge thermistor **62**. The inverter driving circuit **68** supplies a high frequency current to the coil **56**.

Hereinafter, a description will be made of an operation of the fixing device **34** during a fixing operation.

If there is a printing request after the fixing belt **50** reaches a fixing temperature and finishes warming-up, the MFP **10** (refer to FIG. **1**) starts a printing operation. The MFP **10** forms a toner image on the sheet P in the printer unit **18** and transports the sheet P to the fixing device **34**.

In the MFP **10**, the sheet P on which the toner image is formed passes the nip **54** between the fixing belt **50** reaching the fixing temperature and the press roller **51**. The fixing device **34** fixes the toner image to the sheet P. During the fixing, the IH control circuit **67** controls the IH coil unit **52** so that the fixing belt **50** is kept at the fixing temperature.

Due to the fixing operation, the heat of the fixing belt **50** is taken by the sheet P. For example, if sheets continuously pass at a high speed, heat is excessively taken by the sheet P, and thus the fixing belt **50** with low heat capacity may not be kept at the fixing temperature. The heating of the fixing belt **50** is assisted by the second magnetic path **82** formed between the heat generation layer **50***a* and the first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69**, and thus deficiency of a belt heat generation amount is supplemented. Since the fixing belt **50** is heated by the second magnetic path **82**, a temperature of the fixing belt **50** is maintained to be the fixing temperature even if sheets continuously pass at a high speed.

Meanwhile, the heat capacity of the fixing belt **50** is small in order to reduce the warming-up time or the like. The fixing belt **50** obtains enough heat capacity for fixation of the sheet P with the assistance of heating caused by the first magnetic path **81** and the second magnetic path **82**. A region through which the sheet P passes and a region through the sheet P does not pass are generated in the fixing belt **50** depending on a size of the sheet P. Hereinafter, a case where a sheet having the A4R width or having a width smaller than the A4R width is referred to as "during passing of a sheet with a small size". A case where A3 paper passes is referred to as "during passing of a sheet with a large size". If a fixing operation is continuously performed during passing of a sheet having a small size, a temperature decreases in the sheet passing region AR**1** of the fixing belt **50**, and a temperature increases in the sheet non-passing region AR**2**.

On the other hand, if paper continuously passes, a temperature of the magnetic shunt alloy is hard to control. Since a temperature of the magnetic shunt alloy is hard to control, a phenomenon in which the magnetic shunt alloy exceeds the Curie point frequently occurs, and thus an excessive amount of current flows through the IGBT element **68***a*. If the excessive amount of current flows through the IGBT element **68***a*, a temperature of the IGBT element **68***a* may be excessively increased, and thus the IGBT element **68***a* may be damaged.

For example, in order to prevent deterioration in heating assistance of the fixing belt **50** and damage of the IGBT element **68***a*, a magnetic body such as SUS430 may be provided in the sheet passing region AR**1** in addition to the magnetic shunt alloy. However, if the magnetic body is provided, self-heat-generation of the magnetic body does not stop, and thus an internal temperature of the fixing belt **50** increases. If the internal temperature of the fixing belt **50** increases, the thermostat **63** may cause operation errors.

According to the first exemplary embodiment, the first auxiliary heat generation plate **90** opposes the sheet passing region AR**1** in the belt width direction. The first auxiliary heat generation plate **90** contains ferrite. The ferrite does not generate heat by itself due to an induced current generated by the IH coil unit **52**. Since the first auxiliary heat generation plate **90** contains the ferrite, the increase in the internal temperature of the fixing belt **50** is prevented when the magnetic body generating heat by itself is provided. Since the increase in the internal temperature of the fixing belt **50** is prevented, the thermostat **63** of the fixing device **34** which normally operates is prevented from causing operation errors. Since the first auxiliary heat generation plate **90** opposes the sheet passing region AR**1**, the IGBT element **68***a* can be prevented from being damaged when the magnetic shunt alloy opposes the sheet passing region AR**1**.

The second auxiliary heat generation plate **69** opposes the sheet non-passing region AR**2** in the belt width direction. The second auxiliary heat generation plate **69** contains a magnetic shunt alloy as a magnetic material. The magnetic shunt alloy has weakened magnetism with the Curie point as a boundary, and thus heating assistance of the fixing belt **50** is weakened. Since the second auxiliary heat generation plate **69** contains the magnetic shunt alloy, a temperature of the sheet non-passing region AR**2** of the fixing belt **50** is prevented from excessively increasing during passing of a sheet having a small size.

The first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** are disposed in a region surrounded by the fixing belt **50**. The first auxiliary heat generation plate **90** is disposed further toward the inside of the fixing belt **50** in the diameter direction than the second auxiliary heat generation plate **69**. An increase in an internal temperature of the fixing belt **50** is prevented more than if the second auxiliary heat generation plate **69** is disposed further toward the inside of the fixing belt **50** in the diameter direction than the first auxiliary heat generation plate **90**. Since an internal temperature of the fixing belt **50** is prevented from increasing, temperatures of components inside the fixing belt **50** are prevented from increasing. Since temperatures of the components inside the fixing belt **50** are prevented from increasing, the components inside the fixing belt **50** can be prevented from being damaged.

The end of the first auxiliary heat generation plate **90** on the sheet non-passing region AR**2** side and the ends of the first division portion **69***a* and the second division portion **69***b* on the sheet passing region AR**1** side overlap each other when viewed from the thickness direction of the fixing belt **50**. Temperature unevenness is prevented from occurring in the fixing belt **50** between the sheet passing region AR**1** and the sheet non-passing region AR**2** when the end of the first auxiliary heat generation plate **90** on the sheet non-passing region AR**2** side and the ends of the first division portion **69***a* and the second division portion **69***b* on the sheet passing region AR**1** side separate from each other when viewed from the thickness direction of the fixing belt **50**. Since temperature unevenness is prevented from occurring in the fixing belt **50** between the sheet passing region AR**1** and the sheet non-passing region AR**2**, the fixing belt **50** can be made to uniformly generate heat.

The first auxiliary heat generation plate **90** is located at the center of the fixing belt **50** in the belt width direction. The second auxiliary heat generation plate **69** includes the first division portion **69***a* and the second division portion **69***b*. The first division portion **69***a* is located at the first end of both ends of the fixing belt **50** in the belt width direction. The second division portion **69***b* is located at the second end of both ends of the fixing belt **50** in the belt width direction. In a center-fixed fixation type belt, the fixing belt **50** can be made to uniformly generate heat.

The first auxiliary heat generation plate **90** and the second auxiliary heat generation plate **69** are disposed in a region surrounded by the fixing belt **50**. The second auxiliary heat generation plate **69** is closer to the inner circumferential surface of the fixing belt **50** than the first auxiliary heat generation plate **90**. The temperature responsiveness of the second auxiliary heat generation plate **69** improves more than if the first auxiliary heat generation plate **90** is closer to the inner circumferential surface of the fixing belt **50** than the second auxiliary heat generation plate **69**.

Hereinafter, a fixing device according to a second exemplary embodiment will be described with reference to FIG. **7**. The second exemplary embodiment employs a side-fixed fixation type and is thus different from the first exemplary embodiment which employs the center-fixed fixation type. In the second exemplary embodiment, the same constituent elements as the constituent elements described in the first exemplary embodiment are given the same reference numerals, and detailed description thereof will be omitted.

FIG. **7** is a diagram illustrating an arrangement of a first auxiliary heat generation plate **290**, a second auxiliary heat generation plate **269**, the fixing belt **50**, and the IH coil unit **52** according to the second exemplary embodiment.

As illustrated in FIG. **7**, the first auxiliary heat generation plate **290** is located at a first end of both ends of the fixing belt **50** in the belt width direction. The second auxiliary heat generation plate **269** is located at a second end of both ends of the fixing belt **50** in the belt width direction.

Hereinafter, a length W**11** of the sheet passing region AR**1** in the belt width direction is referred to as a "sheet passing region width". In addition, a length W**12** of the sheet non-passing region AR**2** in the belt width direction is referred to as a "sheet non-passing region width".

For example, the sheet passing region width W**11** is set to the same size as the A4R width. For example, the sheet non-passing region AR**2** is a region through A4R does not pass. For example, the great sheet width WS is set to the same size as a short side width of A3 paper. The belt width WT is a size obtained by adding the sheet passing region width W**11** and the first sheet non-passing region width W**12** together.

The first auxiliary heat generation plate **290** opposes the sheet passing region AR**1**. The second auxiliary heat generation plate **269** opposes the sheet non-passing region AR**2**.

An end of the first auxiliary heat generation plate **290** on the sheet non-passing region AR**2** side and an end of the second auxiliary heat generation plate **269** on the sheet passing region AR**1** side overlap each other when viewed from the thickness direction of the fixing belt **50**.

Hereinafter, a length L**11** of the first auxiliary heat generation plate **290** in the belt width direction is referred to as a "first auxiliary heat generation plate width". A length L**12** of the second auxiliary heat generation plate **269** in the belt width direction is referred to as a "second auxiliary heat generation plate width".

The first auxiliary heat generation plate width L**11** is greater than the sheet passing region width W**11**. For example, a ratio L**11**/W**11** between the first auxiliary heat generation plate width L**11** and the sheet passing region width W**11** is about 1.0 to 1.2.

The first auxiliary heat generation plate **290** separates from the first end of the fixing belt **50**. The first auxiliary heat generation plate **290** includes an extending portion **291**. The extending portion **291** exceeds the sheet passing region AR**1** and faces the second auxiliary heat generation plate **269**.

The second auxiliary heat generation plate width L**12** is greater than the sheet non-passing region width W**12**. For example, a ratio L**12**/W**12** between the second auxiliary heat generation plate width L**12** and the sheet non-passing region width W**12** is about 1.0 to 1.2.

The second auxiliary heat generation plate **269** separates from the second end of the fixing belt **50**. The second auxiliary heat generation plate **269** includes an extending portion **294**. The extending portion **294** exceeds the sheet non-passing region AR**2** and faces the first auxiliary heat generation plate **90**.

Hereinafter, a length of the extending portion **291** of the first auxiliary heat generation plate **290** in the belt width direction is referred to as an "extending portion width of the first auxiliary heat generation plate". A length of the extending portion **294** of the second auxiliary heat generation plate **269** in the belt width direction is referred to as an "extending portion width of the second auxiliary heat generation plate". The extending portion width of the second auxiliary heat generation plate **269** is greater than the extending portion width of the first auxiliary heat generation plate **290**.

The first auxiliary heat generation plate width L**11** may be equal to or smaller than the sheet passing region width W**11**. The first auxiliary heat generation plate **290** may be in contact with the first end of the fixing belt **50**. The second auxiliary heat generation plate width L**12** may be equal to or smaller than the sheet non-passing region width W**12**. The second auxiliary heat generation plate **269** may be in contact with the second end of the fixing belt **50**. The extending portion width of the second auxiliary heat generation plate **269** may be equal to or smaller than the extending portion width of the first auxiliary heat generation plate **290**.

According to the second exemplary embodiment, the first auxiliary heat generation plate **290** is located at the first end of both ends of the fixing belt **50** in the belt width direction. The second auxiliary heat generation plate **269** is located at the second end of both ends of the fixing belt **50** in the belt width direction. In the side-fixed fixation type, the fixing belt **50** can be made to uniformly generate heat.

According to at least one exemplary embodiment described above, the first auxiliary heat generation plate **90** opposes the sheet passing region AR**1** in the belt width direction. The first auxiliary heat generation plate **90** contains the ferrite. The ferrite does not generate heat by itself due to an induced current generated by the IH coil unit **52**. Since the first auxiliary heat generation plate **90** contains the ferrite, the increase in the internal temperature of the fixing belt **50** is prevented when the magnetic body generating heat by itself is provided. Since the increase in the internal temperature of the fixing belt **50** is prevented, the thermostat **63** of the fixing device **34** which normally operates is prevented from causing operation errors. Since the first auxiliary heat generation plate **90** opposes the sheet passing region AR**1**, the IGBT element **68***a* can be prevented from being damaged when the magnetic shunt alloy opposes the sheet passing region AR**1**.

While certain embodiments have been described these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel embodiments described herein may be embodied in a variety of other forms: furthermore various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the inventions. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the invention.

What is claimed is:

1. A fixing device comprising:

a fixing belt that includes a conductive layer;

an induced current generation section that opposes the fixing belt in a thickness direction and performs electromagnetic induction heating on the conductive layer;

a first auxiliary heat generation section that opposes the induced current generation section with the fixing belt interposed therebetween, the first auxiliary heat generation section opposes a sheet passing region of the fixing belt in a width direction, and ferrite forms the first auxiliary heat generation section; and

a second auxiliary heat generation section that opposes the induced current generation section with the fixing belt interposed therebetween, the second auxiliary heat generation section opposes a sheet non-passing region of the fixing belt in the width direction, and a magnetic shunt alloy forms the second auxiliary heat generation section.

2. The device according to claim **1**,

wherein an end of the first auxiliary heat generation section on the sheet non-passing region side and an end of the second auxiliary heat generation section on the sheet passing region side overlap each other when viewed from a thickness direction of the fixing belt.

3. The device according to claim **1**,

wherein the first auxiliary heat generation section is located at a center of the fixing belt in the width direction, and

wherein the second auxiliary heat generation section includes a first division portion that is located at a first end of both ends of the fixing belt in the width direction, and a second division portion that is located at a second end of both the ends.

4. The device according to claim **3**,

wherein a length of the first auxiliary heat generation section in the width direction is greater than a length of the sheet passing region in the width direction.

5. The device according to claim **3**,

wherein a length of the first division portion in the width direction is greater than a length of the sheet non-passing region located at the first end in the width direction, and

wherein a length of the second division portion in the width direction is greater than a length of the sheet non-passing region located at the second end in the width direction.

6. The device according to claim **1**,

wherein the first auxiliary heat generation section is located at a first end of both ends of the fixing belt in the width direction, and

wherein the second auxiliary heat generation section is located at a second end of both the ends.

7. The device according to claim **6**,

wherein a length of the first auxiliary heat generation section in the width direction is greater than a length of the sheet passing region in the width direction.

8. The device according to claim **6**,

wherein a length of the second auxiliary heat generation section in the width direction is greater than a length of the sheet non-passing region in the width direction.

9. The device according to claim **1**,

wherein the first auxiliary heat generation section and the second auxiliary heat generation section are disposed in a region surrounded by the fixing belt, and

wherein the second auxiliary heat generation section is closer to an inner circumferential surface of the fixing belt than the first auxiliary heat generation section.

10. A fixing device comprising:

a fixing belt that includes a conductive layer;

an induced current generation section that opposes the fixing belt in a thickness direction and performs electromagnetic induction heating on the conductive layer;

a first auxiliary heat generation section that opposes the induced current generation section with the fixing belt interposed therebetween, and a ferrite forms the first auxiliary heat generation section; and

a second auxiliary heat generation section that opposes the induced current generation section with the fixing belt interposed therebetween, and a magnetic shunt alloy forms the second auxiliary heat generation section,

wherein the first auxiliary heat generation section and the second auxiliary heat generation section are disposed in a region surrounded by the fixing belt, and

wherein the first auxiliary heat generation section is located further toward an inside of the fixing belt in a diameter direction than the second auxiliary heat generation section.

11. The fixing device of claim **10**,

wherein the ferrite and the magnetic shunt alloy overlap each other when viewed from a thickness direction of the fixing belt.

12. The fixing device of claim **10**,

wherein the magnetic shunt alloy comprises a first division portion that is located at a first side of both ends of the fixing belt in the width direction, and a second division portion that is located at a second side of both the ends.

13. The fixing device of claim **12**,

wherein the ferrite is located at a center of the fixing belt in the width direction.

14. The fixing device of claim **13**,

wherein the magnetic shunt alloy is closer to an inner circumferential surface of the fixing belt than the ferrite.

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